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**“जानने का अधिकार, जीने का अधिकार”**

Mazdoor Kisan Shakti Sangathan

“The Right to Information, The Right to Live”

**“पुराने को छोड़ नये के तरफ”**

Jawaharlal Nehru

“Step Out From the Old to the New”

IS 12257-1 (1987): Pneumatic Length Measurement Comparators, Part 1: General Information on Principles and Methods [PGD 25: Engineering Metrology]

**“ज्ञान से एक नये भारत का निर्माण”**

Satyanareshwar Gangaram Pitroda

“Invent a New India Using Knowledge”



**“ज्ञान एक ऐसा खजाना है जो कभी चुराया नहीं जा सकता है”**

Bhartṛhari—Nītiśākām

“Knowledge is such a treasure which cannot be stolen”





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*Indian Standard*

**SPECIFICATION FOR  
PNEUMATIC LENGTH MEASUREMENT COMPARATORS**  
**PART 1 GENERAL INFORMATION ON PRINCIPLES AND METHODS**

**1. Scope** — Covers the principles and methods of pneumatic length measurement (air gauging).

**2. Operating Principle**

2.1 The medium used for measurement is compressed air. When pressurized air, while escaping through an orifice of controlled size, is impeded in its free flow by impinging a solid surface, the distance of that surface from the air escape opening will effect the air flow and create back pressure upstream of the air escape proportional to the distance between the nozzle and the solid surface. In case of pneumatic length measuring methods, this air escape opening is formed by an 'annular area' between nozzle face and the work surface ' $A_s$ ' =  $\pi d s$  (see Fig. 1).

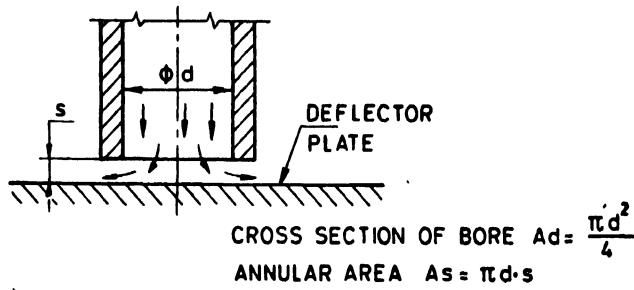


FIG. 1

The annular area ' $A_s$ ' must not be larger than the cross-section of the bore ' $Ad$ '. This means that the principle will generally only operate if the distance ' $s$ ' between jet and the deflector plate does not exceed 1/4th of the bore diameter ' $d$ '. This relationship applies similarly to jets with other forms of cross-section.

2.2 Change of the distance ' $s$ ' changes the volume of air flow.

2.3 This principle is used in various ways for methods of pneumatic length measurement.

3. Methods of Measurement — The methods of measurement vary according to the measurement of one of the three variable quantities of flow, pressure and velocity respectively. These methods of measurement make use of instruments having different circuits (see 6).

3.1 Volumetric Flow Method — In this method, the dimensional change in ' $s$ ' is converted to a volumetric flow change which is directly measured (see Fig. 2).

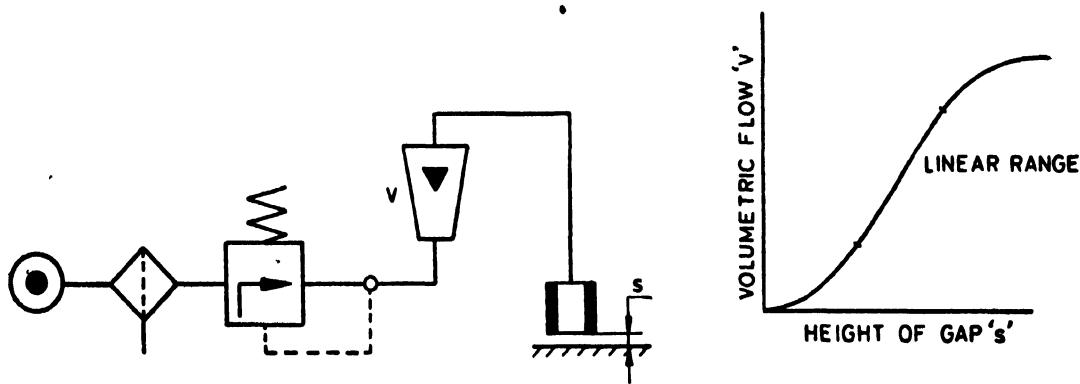


FIG. 2

**3.2 Pressure Measuring Method** — In this method the dimensional change is converted to a volumetric flow change. This volumetric flow is then converted to pressure change by a pilot jet which is measured ( see Fig. 3 ).

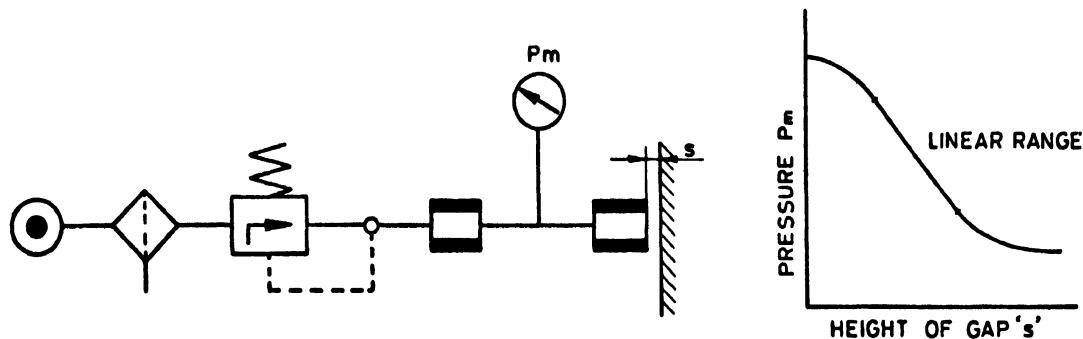


FIG. 3

**3.3 Velocity Measuring Method** — In this method the dimensional change is converted to a volumetric flow change which in turn is converted to velocity change by a suitable restrictor ( that is a venturi ). This velocity change results in a pressure difference which is measured ( see Fig. 4 ).

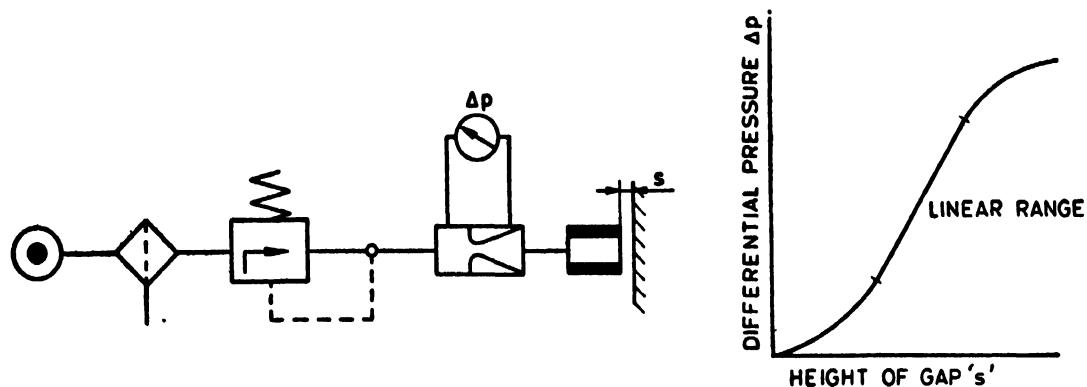
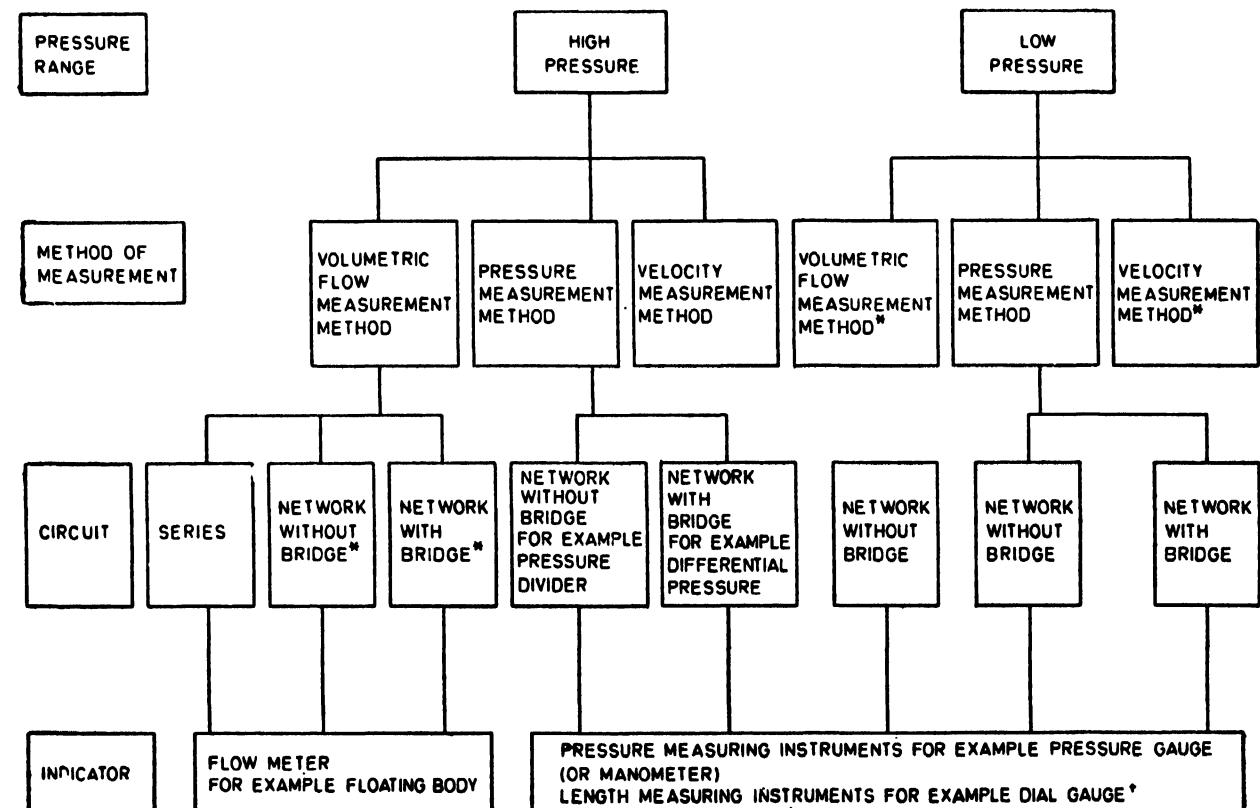


FIG. 4

#### 4. Different Air Gauging System ( Summary )



\*Not achieved in instruments.

\*\*Only in the case of instruments with pressure-displacement converter, for example, diaphragm.

**AMENDMENT NO.1 JANUARY 1992  
TO  
IS 12257 (Part 1) : 1987 SPECIFICATION FOR  
PNEUMATIC LENGTH MEASUREMENT  
COMPARATORS**

**PART 1 GENERAL INFORMATION ON PRINCIPLES AND  
METHODS**

(*Page 1, rule*) — Substitute the following for the existing title:

*'Indian Standard*

**PNEUMATIC MEASUREMENT**

**PART 1 GENERAL INFORMATION ON PRINCIPLES AND  
METHODS'**

(LMD 05)

## 5. Pressure Ranges

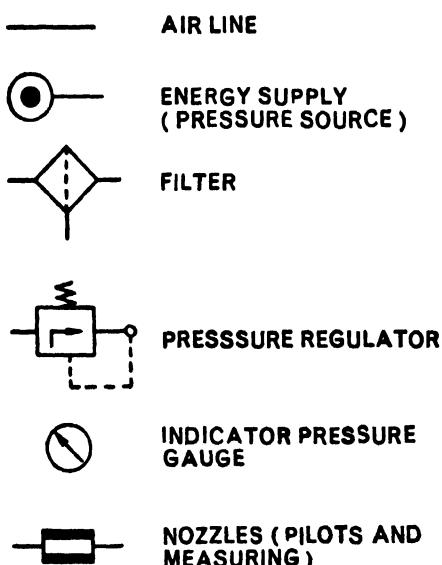
**5.1 High Pressure** — High pressure as defined in this standard means an input pressure  $P_1 \geq 0.5$  bar after the pressure regulator.

**5.2 Low Pressure** — Low pressure as defined in this standard means an input pressure  $P_1 \leq 0.1$  bar after the pressure regulator.

**Note** — The pressure range between 0.1 and 0.5 bar is not used for instruments, since in this range the change of external pressure and the change from laminar to turbulent flow in the flow channel upsets the characteristics of the instrument.

**6. Circuit** — A circuit as defined in this standard means the connections between the energy supply, the filter, the pressure regulator, the nozzles (pilot and measuring) and the indicator.

### 6.1 Circuit Symbols and Denominations



**6.2 Series Connection** — In the case of series connection, the energy supply, filter, pressure regulator, nozzles and indicator are arranged consecutively (see Fig. 5).

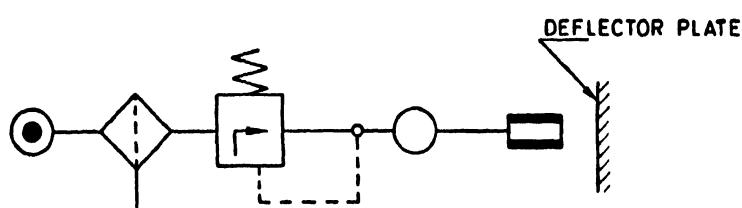


FIG. 5

**6.3 Network Connections** — In the case of network connection, the energy supply, filter, pressure regulator, nozzles and indicator are connected in series and parallel.

#### 6.3.1 Network without bridge — See Fig. 6.

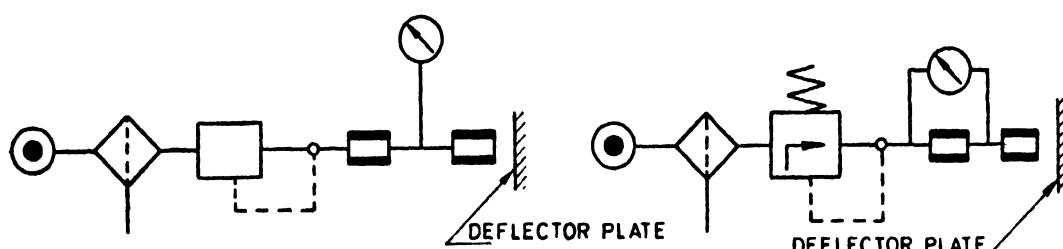


FIG. 6

### 6.3.2 Network with bridge — See Fig. 7.

**6.3.3 Parallel connections ( compound circuit ) of measuring jets** — In parallel connection of measuring jets, several measuring jets can also be positioned against several deflector plates or work surfaces ( see Fig. 8 ).

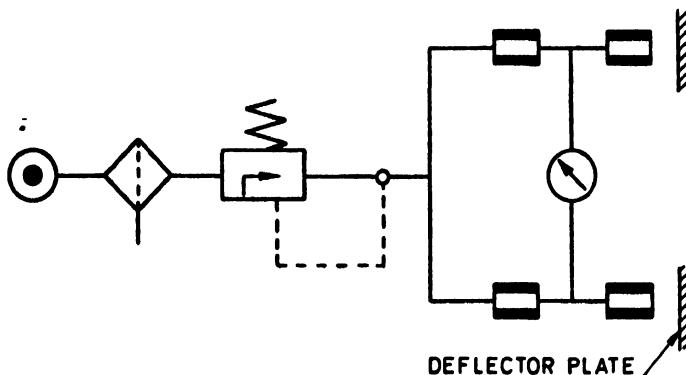


FIG. 7

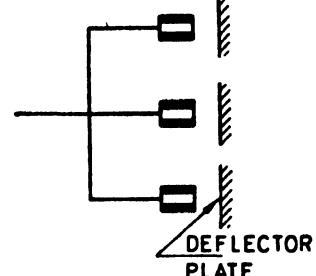


FIG. 8

## 7. Indicator

**7.1 Indicator**, as defined in this standard is a device by which pressure or volumetric flow changes of the medium ( air ) are made visible on straight vertical or circular dials.

**7.2 Indicators with straight vertical scales** are floating body flow meters or fluid pressure gauges that is, liquid manometer.

**7.3 Indicators with circular dials** are Bourdon tube pressure gauges, differential pressure gauges, pressure displacement convertors, that is, measuring displacement due to changed pressure by means of electronic length measuring instrument or dial gauges.

**7.3.1** In case of pressure gauges, the atmospheric air pressure serves as a reference and in case of differential pressure gauges, a back pressure which deviates from a constant pressure.

## EXPLANATORY NOTE

This standard ( Part 1 ) is intentionally limited to the principles and methods of pneumatic length measurement. The aim of this standard is to devise a uniform terminology in this special field and to indicate the various methods of measurement with their special properties.

It is practically observed that it will not be possible to standardize pneumatic length measuring instruments to such an extent whereby the gauging elements and indicating instruments of different manufacturers can be made interchangeable. This is not a question of merely mating dimensions which itself would cause standardization difficulties; more decisive is the fact that the individual parts of various systems are so different that even an exchange of one part can put the whole measuring chain out of action. The zero adjuster and fine pressure adjuster have only a small range of adjustment which permits only interchanging gauging elements of the same system.

The upper limit for low pressure and the lower limit for high pressure in this standard were specified by referring to the relevant literature and the pneumatic length measuring instruments available in the market.

Other parts of this standard are under preparation which will deal with design features, applications and the practical use of pneumatic length measuring instruments. They will also contain examples of measurements for which pneumatic length measuring instruments are advantageous and economic.

This standard ( Part 1 ) is based on DIN 2271 ( Part 1 )-1976 issued by Deutsches Institut für Normung ( DIN ).